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SULPHUR AS AN ECONOMICAL CONTROL FOR THE COTTON FLEA HOPPER

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For the last 12 or 15 years the cotton flea hopper (Psallus seriatus Reut.) has been recognized as a serious pest of cotton. Authentic records have established damage by this insect in every major cotton-growing State. While the insect is distributed over the entire Cotton Belt, the amount and location of its damage vary somewhat from year to year.

The cotton flea hopper is a small insect about one-eighth inch long, pale greenish or grayish, thickly dotted above with brownish spots, and with two characteristic black marks near the tip of each wing. The nymphs or young are wingless and greenish in color. Adults and nymphs are very active and rather difficult to see until one becomes accustomed to looking for them. Both stages feed mostly on the tender parts of the plants, especially in the terminal buds and on small squares. The most serious damage is to the very small squares, which often die when they are no larger than a pinhead. The injured squares turn brown or black and eventually fall from the plants. The blasted squares are so small that they are frequently overlooked, and the failure of the plants to bloom is sometimes attributed to weather or other unfavorable conditions.

The Gulf coast section of Texas probably experiences severe cotton flea hopper damage at more regular intervals than any other large section of the Cotton Belt. For this reason the Bureau of Entomology, in 1933, located a research station in this section, at Port Lavaca, Calhoun County. The information and control recommendations contained in this circular are based mostly on the results of the first two years' work at this station.

FIELD PLOT SULPHUR DUSTING EXPERIMENTS

During 1933 and 1934 a series of dusting experiments were conducted with several different insecticides. As sulphur has so far proved to be the most satisfactory and economical means of controlling the cotton flea hopper, only the results of the sulphur tests will be given.

Eleven sulphur-dusting experiments were conducted in 1933 and six in 1934. The plots of each test were carefully selected, with due regard to uniformity of the soil and cotton, so that the potential production of cotton was the same in the treated and untreated plots. Each plot was 1 acre in size. The treated and untreated plots were either adjacent or separated by only about 30 rows.

For the purpose of comparing the progress of the experiments, field-plot records were made throughout the season on representative portions of each plot. The field-plot inspection records in the different tests of 1934 are summarized in table 1. It will be noted that in the sulphur plots there was considerable reduction in the number of flea hoppers and increase in the number of blooms.

Table 1.--Results of dusting with sulphur as shown by field-plot inspection records. Average of 6 sulphur and 6 check plots. Port Lavaca, Tex., 1934.

Week of inspection	Average number of flea hoppers per 100 buds				Forms (squares, blooms, and bolls), average per plant		Blooms per acre	
	Nymphs		Total nymphs and adults					
	Check	Sulphur	Check	Sulphur	Check	Sulphur	Check	Sulphur
May 14-19	1.9	1.5	72.8	79.8				
21-26	81.9	14.6	132.0	47.4				
28-June 2	97.3	26.8	128.4	45.6	0.11	0.12		
June 4-9	109.6	36.5	144.8	52.6				
11-16	109.6	14.6	162.8	43.9	0.36	0.98		
18-23	74.2	9.6	129.4	34.4			186	868
25-30	25.3	8.7	68.4	21.8	1.13	4.72	309	2,365
July 2-7							799	4,092
9-14	11.6	11.7	18.3	15.0	2.82	6.76	1,377	4,527
16-21							1,080	2,269
23							698	1,024

Tables 2 and 3 show detailed data concerning the number of applications of sulphur and the dosages, as well as the yields of seed cotton, on the different experiments of 1933 and 1934.

Table 2. --Applications of dust and yield of cotton from field-plot experiments at Port Lavaca, Tex., during 1933.

Cut No.	Applications of sulphur				Sulphur per acre-application	Yield of seed cotton per acre		Increase in yield, sulphur over check	
	Total	Effective 1/	Date of — First	Date of — Last		Check plot	Sulphur plot		
					Pounds	Pounds	Pounds	Pounds	Percent
1	4	4	May 16	June 17	11.56	724	874	150	20.7
2	5	5	16	17	11.95	592	944	352	59.5
3	5	4	18	17	12.35	498	822	324	65.1
4	5	5	27	28	12.95	693	860	167	24.1
5	5	4	June 7	July 10	12.70	618	856	238	38.5
6	3	2	7	June 19	11.67	1,050	1,194	144	13.7
7	6	4	8	July 8	12.83	606	974	368	60.7
8	6	4	8	8	12.29	1,252	1,384	132	10.5
9	5	4	20	15	13.70	923	1,334	411	44.5
10	5	3	24	Aug. 19	11.80	410	570	160	39.0
11	4	4	24	19	10.75	172	260	88	51.2
Average	4.8	3.9			12.3	685.3	915.6	230.4	33.6

1/ Applications washed off by rain within 24 hours after dusting were not considered effective and were repeated when possible.

Table 3.--Applications of dust and yield of cotton from field-plot experiments at Port Lavaca, Tex., during 1934.

Cut No.	Applications of sulphur				Sulphur per acre-application	Yield of seed cotton per acre		Increase in yield, sulphur over check	
	Total	Effective	Date of — First	Date of — Last		Check plot	Sulphur plot		
					Pounds	Pounds	Pounds	Pounds	Percent
1	7	7	May 16	June 19	12.29	66	456	390	590.9
2	5	5	16	12	13.40	172	418	246	143.0
3	7	7	16	19	11.89	292	590	298	102.1
4	6	6	17	12	12.67	208	514	306	147.1
5	5	5	18	12	12.00	54	318	264	488.9
6	5	5	18	12	13.90	264	596	332	125.8
Average	5.8	5.8			12.62	176	482	306	173.9

INCREASED PRODUCTION DUE TO SULPHUR

In 1933 the different experiments were located on various farms scattered over a considerable portion of Calhoun County, Tex. The potential production of cotton on the different farms naturally varied, since there was considerable variation in the soil types, drainage, preparation of seed bed, cultivation, etc. The time of starting the dusting varied from May 16 to June 24, the later dates being too late for best results; the infestation in the different plots varied from light to heavy, and the number of effective sulphur applications varied from two to five per plot; consequently optimum results were not expected. But even under such average conditions the experiments showed an average gain of 230.4 pounds of seed cotton per acre as a result of using sulphur for flea hopper control, the range being from 88 to 411 pounds per acre gain.

In 1934 all the experiments were started early in the season, on May 16, 17, and 18. At this time the cotton was about 7 inches tall and just beginning to form squares. There was a very heavy infestation of flea hoppers on all the experimental plots during 1934. On July 25 a tropical hurricane struck the Texas Gulf coast, causing considerable loss to the cotton crop. Boll inspections made in the different experimental fields after the storm showed about 40 percent of the bolls present on the cotton at the time of the storm were damaged so that they were a total loss. Based on this count, the estimated loss from the storm was 290 pounds of seed cotton per acre in the sulphur plots and 84 pounds in the check plots. In spite of damage from the storm, the yield in the sulphur-dusted plots averaged 482 pounds of seed cotton per acre, as against 176 pounds in the check. The average gain from the sulphur dusting was 306 pounds per acre, the maximum being 390 pounds and the minimum 246 pounds.

PROFIT FROM SULPHUR DUSTING

In computing the cost and profit from the dusting operations the following basis was used: Cost of applying the dust (labor, machinery, etc.) at 25 cents per acre-application; cost of sulphur at current market price (in 1933 the price was less than 3 cents and in 1934 slightly above 3 cents per pound in small lots); the value of cotton was taken at 12 cents per pound and of cottonseed at $35 per ton. Thirty-five percent of the seed cotton was figured as lint.

In 1933 the average cost of dusting was $2.54 per acre, or 53 cents per acre-application, and the value of the increased poundage of cotton was $12.29; leaving a profit of $9.75 per acre as a result of the use of sulphur for flea hopper control.

In 1934 the cost of dusting averaged $3.67 per acre, or 63 cents per acre-application, and the value of the increased production was $16.33; or a profit of $12.66 per acre.

RECOMMENDATIONS

Use sulphur.--There is no reason why the flea hopper should be allowed to prevent the setting of fruit during the normal cotton producing season and the farmer take a chance on making a partial late crop. A late crop nearly always disrupts normal farm operations, adding expense and inconvenience to the late harvesting and late fall plowing, and often necessitating more expensive control measures late in the season on other injurious insects, such as the boll weevil, leaf worm, and boll worm.

Sulphur is recommended as an economical means of controlling the cotton flea hopper, so that a crop of cotton can be produced early in the season. There are several sulphur companies that produce sulphur suitable for cotton dusting. Sulphur refined or prepared so that at least 99 percent passes a 200-mesh screen, or so that 95 percent passes a 300-mesh screen, is recommended. Sublimed flowers of sulphur is not recommended for the most economical control.

Kind of machines.--Most any dusting machine suitable for the proper distribution of calcium arsenate will also satisfactorily distribute sulphur. Since sulphur is heavier than calcium arsenate, the feed-control valve will have to be adjusted to regulate the proper poundage of the special grade of sulphur being used. In making plans for a dusting program it is important to keep in mind that sufficient machinery should be available to take care of the acreage at 5-day intervals, with due allowance for probable unfavorable weather conditions and other interruptions. Detailed information concerning machinery for dusting cotton will be found in Farmers' Bulletin No. 1729.

Poundage.--Twelve pounds of sulphur per acre-application is usually satisfactory, when atmospheric conditions are favorable for the dust to stick. Sulphur is cheap, so be sure the cotton is properly covered, even if a higher poundage is necessary for this result. Sulphur has no injurious effect upon the cotton plant. From 18 to 20 pounds per acre have been used to good advantage. Do not use less than 12 pounds per acre.

When to start dusting.--Dusting should start when flea hoppers first become abundant enough to cause damage, or when there are approximately 25 flea hoppers per 100 buds. A close watch for the flea hopper should be made from the time the cotton commences to square until the plant sets a crop of bolls. The most satisfactory method of determining the infestation is by inspecting the main-stem terminal buds. The flea hopper feeds mostly in the buds of the cotton plant, especially in the main-stem terminals, which contain more cover than the other parts of the plant. To determine the flea hopper infestation, examine the terminal buds of 100 plants at several different points in the field. Record the number of adults (specimens with wings) and nymphs (immature or wingless flea hoppers). If the counts average around 25 flea hoppers per 100 buds, more than likely injurious damage is being done and control measures should be started at once.

Number of applications.--Usually four or five applications will give control of average infestations. In the case of a light infestation two applications may be all that is necessary. On the other hand, a heavy infestation may require six or seven applications. The main thing is to start dusting immediately after the flea hopper becomes abundant enough to cause damage and continue until the infestation is brought down below the danger point. With a continued migration of adults into the field, the period of dusting will necessarily be prolonged. Do not become discouraged if two applications fail to show any visible results in the way of an increase in the number of large squares or blooms. The cotton flea hopper, in the process of feeding, injects a poison into the cotton plant that is toxic to the embryonic squares. In the case of severe injury, blasted squares continue to appear for several days and sometimes as long as two weeks after the insects are removed from the plant. Consequently, it often takes several weeks after the flea hoppers are killed before the cotton plants react to form visible squares, or, if the plants are far enough advanced, before an increase in blooms is particularly noticeable.

Time of day to dust.--The ideal condition for dusting is when the air is calm and the cotton is damp. The maximum adherence of sulphur to the cotton plants is secured under these conditions. On large-scale dusting, for instance, where one five-row machine takes care of 75 acres or more, this necessarily means dusting at night. When it is necessary for a machine of this size to care for only from 35 to 50 acres, the dusting schedule can probably be arranged so that the dusting can be done between daylight and the time the dew dries off the cotton. Dusting may be done when the plants are dry if the air is calm, but this condition seldom occurs along the Gulf coast.

Schedule of dusting.--The best results have been obtained by dusting at 5-day intervals until the the infestation is brought under control. With light infestations slightly longer intervals between applications may be satisfactory, but they are not recommended because of the increased danger of getting behind the schedule on account of rains.